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The Epidemiology of Lung Cancer

Recent Trends

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A retrospective epidemiologic investigation of 350 lung cancer patients confirmed the close association between cigarette smoking and lung cancer, particularly of the squamous and oat cell types. New trends in this study show that there is a decrease in relative risk for those patients developing lung cancer ten years after they have switched to filter cigarettes, possibly due to the lower "tar" content in filter cigarettes smoked by these patients. The risk also declines after complete cessation of smoking and appears to approach the level of nonsmokers after 13 years of not smoking. Further efforts to produce less harmful tobacco products should be continued and expanded although no smoking or cessation of smoking is the most effective prevention against lung cancer.

With a wealth of epidemiologic studies on the etiology of lung cancer in the literature, it may not seem worth the effort to report yet again on the environmental background of a group of lung cancer patients.[1-4] However, such a study is of value if it can show evidence of changes, particularly in time trends, in the epidemiological background of these patients.

In a great many epidemiologic studies, it has been found that, among cigarette smokers, the risk of lung cancer increases with the number of cigarettes smoked per day.[1-4] In other words, there is a dose-response relationship. This suggests that reducing dosage by means of reducing the concentration of the smoke from each cigarette might have the same effect as reducing the number of cigarettes smoked per day. If "tar" is the principal harmful ingredient, then it would be sufficient to reduce the concentration of the tar.

The Hammond study on ex-smokers aged 50 to 69 years who had smoked 20 or more cigarettes daily, shows that after ten years of not smoking they have a death rate similar to that of nonsmokers.[3]

These two pieces of evidence taken together suggest the following hypothesis:

> If tar is the principal lung cancer inducing factor then people who have switched from high tar cigarettes to low tar cigarettes should have lower rates of lung cancer than those who continue to smoke high tar cigarettes—this taking place ten or more years after the switch.

The present study was undertaken to test this hypothesis.

Methods of Study

Lung cancer patients admitted to the Memorial Sloan-Kettering Cancer Center in New York City are interviewed routinely about their background and social habits.

Each patient included in this report has a histologically-proven lung cancer and was interviewed between November 1966 and August 1969. The study group consisted of 210 men and 30 women with Kreyberg

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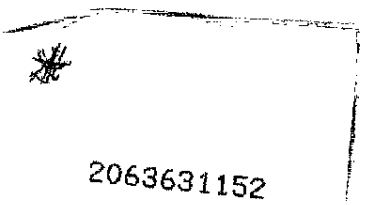

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Table 1.—Type of Smoking and Number of Cigarettes Smoked by Lung Cancer Patients and Controls

Male	Kreyberg 1		Kreyberg 2		Control	
	No.	(%)	No.	(%)	No.	(%)
Nonsmokers	3	(1.4)	6	(8.1)	88	(21.0)
Current smokers + exsmokers (1-9 yr)						
Cigarette smokers	191	(91.0)	61	(82.4)	199	(47.4)
Pipes and/or cigars only	10	(4.8)	3	(4.1)	64	(15.2)
Exsmokers (10 + yr)						
Cigarettes	6	(2.9)	3	(4.1)	65	(15.5)
Pipes and/or cigars only	0	(0)	1	(1.4)	4	(1.0)
Total Male Patients	210	(100)	74	(100)	420	(100)
No. of cigarettes per day						
1 to 9	7	(3.6)	1	(1.6)	42	(15.9)
10 to 20	57	(28.9)	20	(31.3)	114	(43.2)
21 to 40	74	(37.6)	34	(53.1)	82	(31.1)
41+	59	(29.9)	9	(14.1)	26	(9.8)
Total Cigarette Smokers	197	(100)	64	(100)	264	(100)
Female						
Nonsmokers	5	(16.7)	15	(41.7)	76	(57.6)
Current smokers + exsmokers (1-9 yr)						
Cigarette smokers	24	(80.0)	21	(58.3)	53	(40.2)
Exsmokers (10 + yr)	1	(3.3)	0	(0)	3	(2.3)
Total Female Patients	30	(100)	36	(100)	132	(100)
No. of cigarettes per day						
1 to 9	1	(4.0)	2	(9.5)	19	(33.9)
10 to 20	13	(52.0)	11	(52.4)	24	(42.9)
21 to 40	8	(32.0)	7	(33.3)	10	(17.9)
41+	3	(12.0)	1	(4.8)	3	(5.4)
Total Cigarette Smokers	25	(100)	21	(100)	56	(100)

Table 2.—Histological Type and Sex Ratio of Lung Cancer Patients

	Male		Female		Sex Ratio (Male:Female)
	No.	(%)	No.	(%)	
Kreybird group 1	210	(73.9)	30	(45.5)	7.00:1
Kreyberg group 2	74	(26.1)	36	(54.5)	2.06:1
Totals	284	(100)	66	(100)	4.30:1

group 1 cancer of the lung (squamous and oat cell types) and 74 men and 36 women with Kreyberg group 2 (glandular) cancer of the lung. The control group interviewed at Memorial at the same time was twice the size of the cancer group and matched by sex and age to the male Kreyberg 1 patients and all female cancer patients. The criterion for individuals in the control group was that they should have no known tobacco-related diseases.[1-4]

The risk for any subclass relative to that for nonsmokers was computed in a standard fashion,[5] as follows: Let n_1 and n_2 stand for the number of cases and controls respectively in that subclass and let m_1 and m_2 stand for the number of nonsmoking cases and controls. Then the relative risk

$$\text{for the subclass} = \frac{\frac{n_1}{n_2}}{\frac{m_1}{m_2}}$$

Thus, for those smoking 41 or more filtered cigarettes per day, $n_1=25$, $n_2=7$; from Table 1, $m_1=3$; $m_2=88$; and the relative risk is 104.8.

Results

Sex Ratio and Histology.—When the sex ratio of patients with the different histological types of cancer was examined, the Kreyberg 1 group had a greater predominance of men than the Kreyberg 2 group (Table 2).

Age Distribution.—Male Kreyberg 1 cancer patients were somewhat older than the male Kreyberg 2 patients and both groups of women, though the difference between the male Kreyberg 1 and Kreyberg 2 groups was not significant ($t=1.19$; $0.15>P>0.10$). (Table 3).

Religion.—The male Kreyberg 1 cancer group included a significantly lower percentage of Jews than both Kreyberg 2 cancer ($X^2=3.65$, df=1, $10>P>0.105$) and control groups ($X^2=25.65$, df=1, $0.005>P$). (Table 4). The female Kreyberg 2 cancer group also contained a lower proportion of Jews than the controls, but the difference was not statistically significant.

Smoking.—Among the men in the study there was a significantly greater percentage of smokers in both histological groups than in the controls, and greater in Kreyberg 1 than in Kreyberg 2 (Table 1). (Kreyberg 1 and control: $X^2=41.61$, df=1, $0.005>P$; Kreyberg 2 and control: $X^2=5.93$, df=1, $0.05>P>0.10$; Kreyberg 1 and Kreyberg 2: $X^2=5.93$, df=1, $0.05>P>0.01$). The female Kreyberg 1 group also contained a significantly higher percentage of cigarette smokers than the controls ($X^2=14.77$, df=1, $0.05>P$). The difference in smokers between the female Kreyberg 2 and control group was not statistically significant ($X^2=2.28$, df=1, $0.25>P>0.10$).

Amount and Type of Cigarette Smoked.—Data on amount smoked refers to the number of cigarettes smoked daily during the last five years of smoking. Any patient who had smoked at least one cigarette a day for 20 years or more was defined as a cigarette smoker and was included in this analysis. If a patient smoked for less than 20 years, a daily number of cigarettes smoked was calculated as follows: (daily number of cigarettes) = (the average number of cigarettes per day for past 5 years)

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Table 3.—Age Distribution of Lung Cancer Patients

Age at Diagnosis (Yr)	Male				Female			
	Kreyberg 1		Kreyberg 2		Kreyberg 1		Kreyberg 2	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
30-39	3	(1.4)	6	(8.1)	1	(3.3)	4	(11.1)
40-49	31	(14.8)	7	(9.5)	4	(13.3)	2	(5.6)
50-59	56	(26.7)	23	(31.1)	14	(46.7)	15	(41.7)
60-69	83	(39.5)	32	(43.2)	9	(30.0)	11	(30.6)
70-79	33	(15.7)	6	(8.1)	2	(6.7)	4	(11.1)
80+	4	(1.9)	0	(0)	0	(0)	0	(0)
Totals	210	(100)	74	(100)	30	(100)	36	(100)
Mean Age	60.2		57.8		56.6		56.7	

Table 4.—Religious Distribution of Lung Cancer Patients and Controls

Religion	Kreyberg 1		Kreyberg 2		Control	
	No.	(%)	No.	(%)	No.	(%)
Male						
Jews	29	(13.8)	18	(24.3)	139	(33.1)
Catholics	116	(55.2)	33	(44.6)	184	(43.8)
Protestants	65	(31.0)	23	(31.1)	97	(23.1)
Totals	210	(100)	74	(100)	420	(100)
Female						
Jews	5	(16.7)	14	(38.9)	38	(28.8)
Catholics	15	(50.0)	13	(36.1)	56	(42.4)
Protestants	10	(33.3)	9	(25.0)	38	(28.8)
Totals	30	(100)	36	(100)	132	(100)

Table 5.—Number and Type of Cigarettes Smoked by Male Lung Cancer Patients and Controls

No. Cigarettes per Day	Regular				Filter*			
	Kreyberg 1		Control		Kreyberg 1		Control	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
1 to 9	4	(4.9)	6	(9.7)	2	(3.0)	11	(13.4)
10 to 20	24	(29.6)	31	(50.0)	17	(25.8)	36	(43.9)
21 to 40	30	(37.0)	21	(33.9)	22	(33.3)	28	(34.1)
41 +	23	(28.4)	4	(6.5)	25	(37.9)	7	(8.5)
Totals	81	(100)	62	(100)	66	(100)	82	(100)

*Persons who smoked filters for ten or more years after switching from regular cigarettes.

Table 6.—Duration of Exsmoking in Male Lung Cancer Patients and Controls

No. Years Since Stopping Smoking	Kreyberg 1		Kreyberg 2		Control	
	No.	(%)	No.	(%)	No.	(%)
1 to 3	18	(50.0)	3	(25.0)	22	(17.6)
4 to 6	8	(22.2)	3	(25.0)	17	(13.6)
7 to 12	8	(22.2)	3	(25.0)	31	(24.8)
13 +	2	(5.6)	3	(25.0)	55	(44.0)
Totals	36	(100)	12	(100)	125	(100)

× (years of smoking/20 years). Thus, a patient smoking 20 cigarettes daily for ten years was classified as a ten-per-day cigarette smoker. However, such adjustments were rarely necessary.

Among cigarette smokers there was a significantly greater percentage of men who smoked in excess of two packs of cigarettes a day in the Kreyberg 1 group than in both Kreyberg 2 and control groups, (Kreyberg 1 and 2: (X^2=5.53, df=1, $0.05>P>0.01$; Kreyberg 1 and control: X^2=29.00, df=1, $0.005>P$) (Table 1). A similar, but not statistically significant, trend was noted for men between the Kreyberg 2 group and controls, and for women between Kreyberg 2 group and controls.

For the purpose of testing the hypothesis presented in the beginning of this communication, the relative risk for Kreyberg 1 lung cancer was calculated by the method stated before for nonfilter (regular) vs filter cigarette smokers. The former group included persons who smoked nonfilter cigarettes only. The latter, on the other hand, comprised individuals who changed to filter cigarettes and had smoked them for at least ten years. In the preliminary analysis, it was found that persons who had quit smoking for a long period of time had smoked more nonfilter cigarettes before stopping than either current or recent exsmokers, as might be expected because there were, of course, fewer filter cigarettes on the market ten years ago than today. In addition, the control group contained a significantly larger percentage of exsmokers of long duration (Table 1). Therefore, for a statistical comparison of nonfilter and filter cigarettes, an arbitrary ten-year period of exsmoking was chosen and anyone who had not smoked for at least ten years was excluded from this particular analysis.

The results showed that the relative risk increased in proportion to the greater number of cigarettes smoked for both long-term filter and nonfilter smokers, and that the lower relative risk noted for filter smokers as a whole (Fig 1) was similar for all subclasses of smoking amounts (Fig 2). The ratio of nonfilter to filter cigarette smokers was 1.22:1 for the Kreyberg 1 and 0.76:1 for the control patients, indicating more nonfilter cigarette smokers in the lung cancer group than the control group (X^2=3.76, df=1, $0.10>P>0.05$) (Table 5). The data also showed a greater percentage of 40 plus-per-day filter cigarette smokers in the lung cancer group (37.9%) compared with nonfilter cigarette smokers (28.4%), a trend not as

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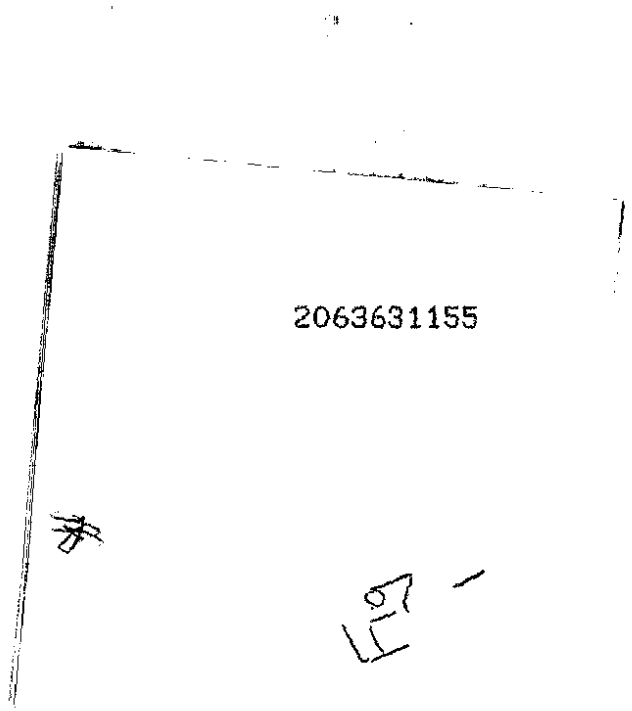

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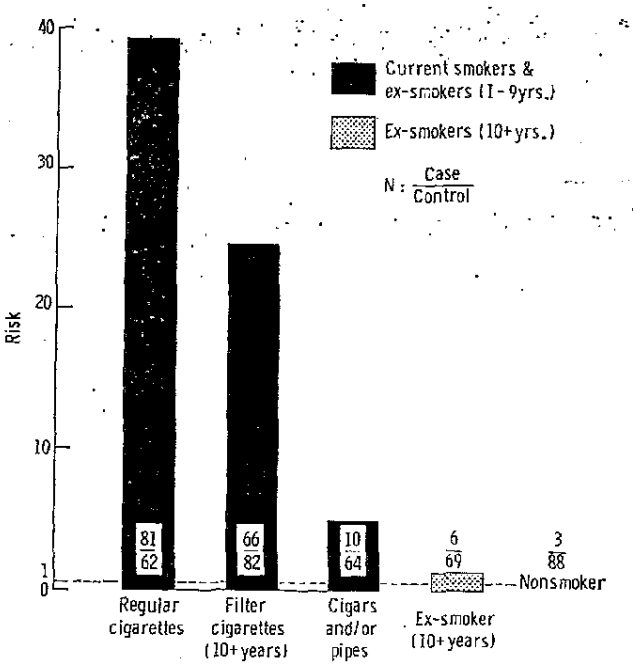
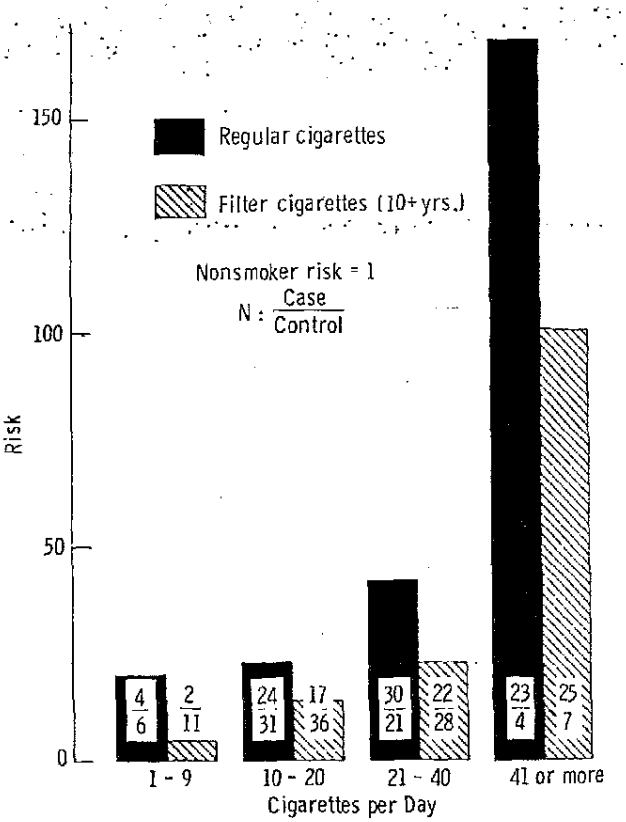
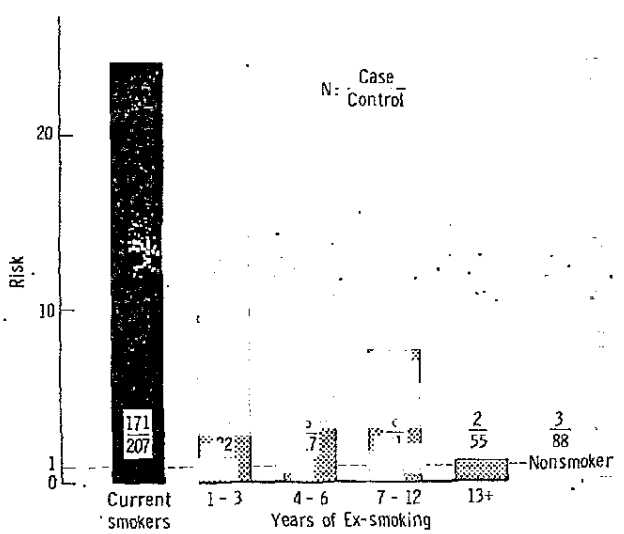


1. Lung cancer risk by type of smoking, in men, Kreyberg group 1.



2. Lung cancer risk by number of cigarettes smoked daily, in men, Kreyberg group 1.



3. Lung cancer risk by years of exsmoking, in men, Kreyberg group 1.

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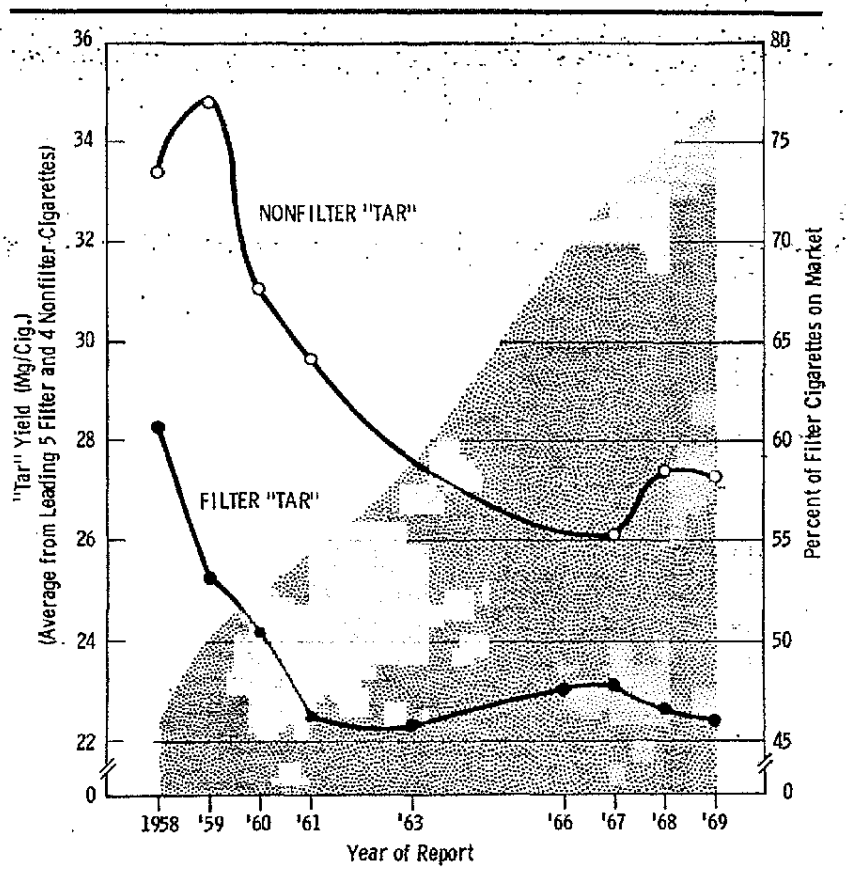
apparent in the control group.

The data were examined in relation to religion (Jewish and non-Jewish), but only 22 of the patients were Jewish men and this was too few to attempt an analysis in relation to the type of cigarettes smoked. However, removing Jews from the data showed the relative risk to be 46.2 for nonfilter smokers (74 cases, 50 controls) and 26.8 for filter smokers (51 cases, 59 controls), thus showing similar differences as found for the total group. Although the original matching of study to control cases was made by age, the data were examined by age group because when it was broken down by smoking category it was possible that the age distribution might be unbalanced. While a higher relative risk was consistently noted for regular, nonfilter, cigarette smokers, in both the under 59 and over 60 age groups, the greatest difference in the relative risk for nonfilter and filter smokers tended to be seen in the younger age group.

A meaningful comparison of the groups smoking filter cigarettes for less than ten years by amount smoked is not possible because only 23 patients with Kreyberg 1 lung cancer had smoked filter cigarettes for one to four years, and 21 for five to nine years.

Cigar and Pipe Smokers.—Although cigarette smoking was shown to be closely related to lung cancer, it must be remembered that cigar and pipe smokers also have a higher relative risk for lung cancer than nonsmokers (Fig 1). Among patients who smoked cigars or pipes or both in this study, the amount consumed by the male Kreyberg 1 cancer patients was greater than by the controls. Of seven Kreyberg 1 cancer patients who smoked cigars only, three smoked ten or more per day compared with four of 55 in the controls. Among those who smoked pipes only, two of four cancer patients and ten of 35 controls smoked ten or more pipes daily. One cancer patient and 26 controls smoked both cigars and pipes.



4. Filter and nonfilter "tar" yields in the United States, 1958-1969. These data are compiled reports in Consumer's Report, Reader's Digest, Federal Trade Commission Reports, Wooten Reports, *and* Maxwell Reports. *The results have been converted to correspond to the standards employed by the Federal Trade Commission.*[18]

Of three Kreyberg 2 male cancer patients, one smoked seven cigars daily, another 5 pipes daily, and the third smoked ten cigars and 11 pipes per day.

Exsmokers.—An examination of the men who had given up smoking at least one year before hospital admission showed that the lung cancer patients stopped smoking more recently than the controls (Table 6). The Kreyberg 1 male group included a significantly higher percentage of persons who stopped smoking less than three years prior to diagnosis than the controls ($X^2=22.32$, df=1, $0.005>P$).

Though the data seem to be based on a rather small number of cases, the relative risk for Kreyberg 1 lung cancer was found to decline steadily after cessation of the smoking habit (Fig 3). The relative risk for those who stopped smoking up to three years previously was the same as for current smokers, but after 13 years the risk appeared to be nearly the same level as that of nonsmokers. Further analyses of exsmokers by age and different exposure to tobac-

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co could not be carried out because of the paucity of cases after such cross-tabulation.

A review of the environmental history of lung cancer patients who were long-term exsmokers might be of interest in view of determining probable exogenous factors that might be related to the etiology of the cancer. The study contained six lung cancer patients who had given up smoking at least ten years prior to diagnosis. Of these six cases, the only one to have smoked for less than 22 years had a most unusual epidemiological history which suggested his lung cancer could have been related to factors other than smoking. Between the ages of eight and ten years, the patient was treated for psoriasis with potassium arsenite. At 27 years of age, he had a lymph node tumor removed from his groin and received x-ray therapy. At the age of 37 years the patient had an epidermoid carcinoma of the scrotum as well as a squamous cancer of the buttock. The present cancer of the lung was diagnosed the following year and seven months later yet another primary, this time adenocarcinoma of the kidney, was detected. There is a possibility that these multiple primaries, particularly of the skin surface, may be associated with high doses of potassium arsenite[6-7] and that the effect of this medication is also related to the lung cancer. Of interest in this respect is the report by Robson and Jelliffe of six patients who developed lung cancer after the therapeutic administration of arsenic.[8] Cahan made a similar observation and suggested a possible synergistic action of the arsenical compound and cigarette smoke. (oral communication from Dr. William Cahan, Aug 18, 1969) A metastatic spread of the scrotal lesion to the lung, although a rare occurrence, is also a possibility.[9]

One exsmoking patient had given up 18 years previously after smoking heavily for 22 years. Another patient who had given up smoking 20 years previously was a carpenter by trade, an occupation often associated with lung cancer in nonsmokers.[10]

Nonsmokers With Lung Cancer: The fact that Kreyberg 1 lung cancer can develop in a nonsmoker, though it is quite rare, needs to be considered. One of the three nonsmokers in the male Kreyberg 1 group was a house painter, Like a carpenter, this is an occupation more common than could be expected among smokers with epidermoid carcinoma of the lung.[10] The second nonsmoker was a 54-year-old physician who received excessive nitrogen and sulfur mustard gas exposures while working in the Chemical Warfare Service in 1942-1946. Really adequate protective clothing and gas masks were not considered very important in those days and on many occasions he suffered blisters and burns on the skin after visiting fields where these gases had been used. The increased occurrence of lung cancer among poison gas workers in Japan is of interest in respect to this case.[11] The third nonsmoker with epidermoid lung cancer was an archaeologist.

Comment

The findings of the present study in respect to filter cigarettes are consistent with the hypothesis presented in the beginning of the communication.

Figure 4 shows the decline in tar content in leading filter and nonfilter brands of cigarettes since 1958 as well as the increased share of the market taken by filters in this period. These are interesting observations since at the beginning of the 1950's, filter cigarettes represented only a very small fraction of the total consumed in the United States.

Conceptually, lung cancer develops when the cumulative tar dose has reached a certain level. If the dose in a single cigarette is reduced by 20% it would be reasonable to assume that to achieve the critical dose level, the individual would have to smoke more cigarettes.

The Hammond study on exsmokers aged 50-69 years who had smoked 20 or more cigarettes daily, shows that after ten years of not smoking, the individuals have a death rate from lung cancer similar to that of nonsmokers.[3] After five to nine years, when Hammond's study shows a decline of 50% among exsmokers, a similar change as found for filter smokers in the present study, can be expected if smokers change to a lower tar cigarette. On the basis of Hammond's study and our hypothesis, no change would be expected among heavy smokers aged 50-69 years who shifted to filter cigarettes and smoked them for five years or less. The Hammond study showed also that exsmokers who had been light smokers (1-19 cigarettes per day) already had a reduced lung cancer risk one to four years after stopping relative to those who had continued smoking. Similar findings were observed by Doll and Hill[3] The present study did not contain sufficient exsmokers to carry out a separate analysis of those who had smoked less than 20 cigarettes per day and who were under 50 years of age.

As none of the lung cancer patients in the present study started out smoking filter cigarettes, the relative risk for individuals who smoked only filter cigarettes could not be determined.

From an experimental point of view, few of the longterm filter smokers in the study used filters that would have selectively removed components toxic to the cilia from the gas phase, such as hydrogen cyanide and volatile aldehydes. Cellulose acetate fibers, from which the vast majority of filters are made, tend to remove selectively some acidic components from smoke. Since available filter materials generally do not selectively remove carcinogenic agents from the particulate matter and the tar from filter cigarettes has the same tumorigenic

Source: https://www.industrydocuments.ucsf.edu/docs/jnpk0000

activity as tar from nonfilter cigarettes when compared on a gram-to-gram basis,[12] the decreased risk for filter smokers shown by the present study appears to relate primarily to the reduction in the total tar content obtained by using filter cigarettes. There is a considerable range in the tar yields of different filter cigarettes. Therefore, the decreased risk for filter smokers is likely to be in direct proportion to the tar content of various brands. This aspect will be explored in subsequent studies.

Through manufacturing changes, the tar content of regular nonfilter cigarettes has also been reduced in recent years so that the present-day nonfilter cigarettes should also be relatively less harmful than they were in the past. This fact may account for the finding that lung cancer patients who smoked nonfilter cigarettes only in the present study tended to have smoked more of them than lung cancer patients in the period 1948-50.[1] In the study by Wynder and Graham in 1950, 20.3% of male patients with squamous cell carcinoma of the lung smoked 35 or more cigarettes or equivalent per day (in these calculations, the data on pipe and cigar smoking was translated into cigarette equivalents and added to number of cigarettes smoked), while in the present study 49.4% of nonfilter smokers with Kreyberg 1 lung cancer consumed 35 or more cigarettes daily.

It is still unclear, however, whether the decreased relative risk of lung cancer for smokers of contemporary cigarettes compared with 20 years ago is related exclusively to differences in tar yield or also to a reduction in carcinogenic activity of the tar. Animal studies suggest that the latter may also be a factor. Through the increased use of lower tar yielding and homogenized tobaccos, and tobacco stems, the tar yield can be diminished partly by enhancing combustion. Such practices have been shown to lead to a decrease in tumorigenic activity of the resulting tars.[12] It is to the further reduction of the carcinogenic materials in tobacco smoke that future research efforts should be directed.

Histologic Considerations.—In view of the varying histological interpretations of lung cancer sections by different pathologists, a precise evaluation of epidemiologic background for two groups of lung cancer patients is difficult even when the data has been collected and reviewed at only one hospital. However, the results of this study are consistent with previous publications suggesting that though both Kreyberg 1 and 2 lesions relate to cigarette smoking, there are certain epidemiological differences between the two groups. In a Kreyberg group, the male to female sex ratio is greater, the subjects smoke significantly more and there are fewer nonsmokers. A male Kreyberg 1 group also tends to be older and includes a lower percentage of Jews than a male Kreyberg 2 group. These differences may be because the cells that convert to Kreyberg 1 lesions have a greater sensitivity to exogenous carcinogens than the cells involved in Kreyberg 2 lesions and also because of the greater tendency for the latter type of lesions to arise in the absence of exogenous influences. It is suggested that epidemiologic studies on lung cancer should continue to separate Kreyberg 1 and 2 lesions.[13]

Epidemiologic Considerations.—As in all epidemiologic studies, one must consider a possibility that a person's reply to questions may be influenced by bias or error in recall.

Individuals in the present study tended to recall well the brand or brands predominantly smoked. While there was some switching from one nonfilter brand to another, or from one filter brand to another, or from nonfilter to filter cigarettes, there were no individuals who changed back to nonfilter cigarettes after more than one year on filters. There may be come error in recall of the precise duration of filter smoking but in general we assume that no difference exists in the accuracy of recall between the study and control patients. There is a potential bias, however, in smoking histories reported by lung cancer patients because the general population is obviously far better acquainted with the association of smoking and cancer than ten years ago. A Gallup Poll described in the *New York Times* found the majority link cigarettes and cancer (18, 1969).

The present study should be regarded as a preliminary report on continuing efforts to monitor the epidemiologic background of lung cancer patients. However, the findings of this study in respect to filter cigarettes are being reported because they are not only biologically reasonable and in line with other findings reported in a retrospective study in the literature,[14] but also because the results could be of practical value and justify further efforts to produce less hazardous cigarettes. Of course, as in all epidemiologic investigations, the possibility that an unknown factor or factors, which correlate with use of filter cigarettes actually provide the correct explanation of the difference, cannot be excluded. For example, those who switch to filter cigarettes may also inhale less and it may be the reduced inhalation rather than the decreased tumorigenic activity of filter cigarettes that accounts for the difference. Only further investigation can clarify these issues.

Subsequent epidemiologic investigations in this area will have to contain a far larger number of subjects so that the risk by various types of cigarettes, ie, cigarettes made of different kinds of tobacco and with different types of filters, can be assessed. Tar and nicotine levels in any one brand of cigarettes usually remain parallel so that the risk for smokers of different types of cigarettes to develop a variety of diseases, in addition to lung cancer, must be

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considered. It is well known that cigarette smokers have an increased mortality and morbidity rate for myocardial infarction especially among men under the age of 50 years.[4,15] In the final analysis, the judgement of whether one cigarette is less harmful to man than another cigarette can only be made by measuring its long-term effect on man himself.

Preventive Considerations.—Clearly, the most successful way to reduce the risk of lung cancer is not to smoke cigarettes in the first place or to give up smoking as early in life as possible.

While individual motivation to cease smoking can and has accomplished much, the great number of Americans who still smoke cigarettes suggests that the large-scale educational efforts against smoking are not likely to be entirely effective. For this reason, we must implement deliberate managerial measures of the type classically so successful in solving public health problems in the past to do their share in reducing the risk of lung cancer and other tobacco-related diseases. While individual motivation should be encouraged more than ever, managerial preventive measures affecting the entire population of smokers must be expanded. The undertaking of effective prevention in this area is the responsibility of all—the government, the tobacco industry, the health professions, and the general public. With the burden to effect change placed on the shoulders of society as a whole, it is society that will reap the harvest of its actions in years to come.

Conclusions

This study was based on 350 lung cancer patients seen at the Memorial Sloan-Kettering Cancer Center between November 1966 and August 1969.

As in previous studies, cigarette smoking is strongly associated with cancer of the lung. This association is greater for the squamous and oat cell types than for the glandular type even though the latter is also related to cigarette smoking.

A lower relative risk of lung cancer (Kreyberg 1 group) was found for individuals who had smoked filter cigarettes for at least ten years after switching from nonfilter cigarettes than for those who continued to smoke nonfilter cigarettes. Since filter cigarettes tend to be lower in tar than nonfilter cigarettes, the results suggest that a reduction in tar yield of a given strength will be associated with a decreased risk for lung cancer unless the smoker compensates for the lower tar dosage by smoking more cigarettes.[16]

The lung cancer risk for individuals who smoked only filter cigarettes cannot be determined at this time.

The relative risk for lung cancer among exsmokers continues to be high for at least three years after cessation of smoking. Thirteen years after an individual has stopped smoking the relative risk appears to be close to that of individuals who never smoked.

Further efforts to produce less harmful tobacco products should be continued and expanded although not smoking or cessation of smoking is the most effective prevention against lung cancer.

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